

VOCATIONAL EDUCATION IN ENGINEERING IN THE INFORMATION AGE

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Index: Course Development, Partnership, Vocational Education, IT.

Abstract: Learning new skills or acquiring new knowledge is becoming part of life for most adults. Indeed, the paradigm of life-long learning has found advocates not only in individuals but also policy-makers. In the information age, life-long learning will be increasingly dependent on the successful application of information and communication technology. This paper outlines recent curriculum developments of this department, highlighting information technology applications for course delivery and management. In catering for the changing needs of local industry, the department seeks to establish partnership with local companies, aiming to expand the department's scope on life-long learning provision at the same time.

INTRODUCTION

Over the past few decades, Hong Kong has transformed itself from a labour-intensive to a service economy. Now, the economy is heading towards a knowledge-based one where intellectual capital takes center stage. Increasingly, employers expect their workforce to be multi-skilled and their employees to have cerebral skills over manual skills. The economic landscape is changing rapidly. In response to these changes, the Hong Kong SAR government is keen to foster a strong life-long learning culture in society, such that the workforce would keep on learning and upgrading their skills and knowledge in order to compete in the global market. As put forward in the 1998 policy address, the government has in fact envisioned Hong Kong becoming a learning society.

To enhance employability, according to a recent survey, 85% of the respondents perceived qualification as a major factor. At present, there are over 300,000 people, some 10% of the working population, receiving continuing education at the higher education level. In satisfying such a demand for self-advancement, there are more than 150 overseas academic and professional institutions, offering over 500 programmes for local consumption. Yet, there are over 700,000 workers, who are over 40, with formal education no higher than Form 3. Based on figures available in year 2000 first quarter, the unemployment rate for this age group was about 6.9%, which was higher than the overall rate of 6.1%. Of even greater concern was the high unemployment rate amongst youths: for the 15-19 age group, it was about 29%. Vocational education providers should therefore seek to offer more opportunities for these two groups, which are particularly vulnerable to future economic changes.

In the information age, e-class room is emerging, making use of information technology(IT), such as video-conferencing, streaming video, and networked PC or the internet for education and training delivery. It offers greater flexibility to learners, overcoming constraints imposed by geography or time. In a city like Hong Kong, where many work irregular hours or travel frequently, learning and self-improvement through IT is a very attractive option. In fact, similar to experience overseas, for instance Edling (2000) and Fayter (1998), many local tertiary institutions are experimenting with the idea of virtual university. Feedback so far has been positive both from students and lecturers. On the whole, the use of IT has shown to greatly enhance traditional methods, adding flexibility, variety, and

convenience to service delivery. Obviously, there are negative effects too, in particular, the lack of human contacts. Nonetheless, with 30% of the population using the internet, especially amongst younger population, the use of IT for teaching and learning must be carefully developed such that wider distribution of knowledge can be achieved at lower costs.

COURSE DEVELOPMENT

The existing courses of this department serve a large cross-section of the community, ranging from young secondary school-leavers of Form 5 or 7 standards, mainly for full-time programmes, to those who are in their late 30's working in the industry taking part-time programmes. By and large, their educational needs are satisfied by a common academic programme, which is comprehensively covered by the department's suites of courses. The development of these suites of courses has been based on many factors, for instance, the need for such courses, the provision of similar courses in Hong Kong and the career prospects for graduates. In addition, efforts have been made to design courses of high academic standards with well-integrated engineering application materials. The aims of our courses are to produce engineering professionals who have a broad based understanding of engineering science and at the same time, develop trade skills which meet the needs of the employers. Bearing in mind the vocational character of these courses, it should be stressed that graduates should have an in-depth knowledge of installation, testing, commissioning, operation and maintenance of systems as well as a good understanding of the application of modern digital electronic control.

These course aims are achieved initially through a curriculum structure that is based on a very well established classical programme. This programme includes theoretical core subjects and more importantly extensive practical training. With the development and expansion of the information technology, current syllabuses now rely heavily on the applications of computers in the process of teaching and learning. Computer application includes interactive communication and simulation of processes and systems which are extremely useful tool to assist learning.

The courses to be offered in the future by this department will extend beyond traditional market segments. In addition to offering courses that award academic qualifications, the department will expand its range of courses gearing towards professional qualifications. For the graduates of these courses (including the academic and the professional ones), the department will design and offer many continuing development programmes to help them keeping abreast with the developments in their own fields. On the other hand, attention will increasingly be given to satisfying the needs for self-advancement and continuing education of the growing population who are without the necessary knowledge and skills for the changing needs of the economy. In those cases, the format and content of the programmes will be designed to suit the academic background of potential students and prevailing economic environment. Short courses, training programmes, skills-based workshops will be offered and supported at every possible instance by the application of the information technology. These courses will be designed and developed in close co-operation with external organisations such as government agencies, academic institutions and the industrial sector.

IT APPLICATIONS

Recognizing the importance of information technology in vocational education, the VTC has recently launched an extensive programme to upgrade the computer infrastructure to provide the necessary support to teaching departments for course delivery and management. The department is now in pursuit of making the necessary changes to make the best use of this technology in our teaching and learning programmes, course management and related activities.

As a first step, teaching and learning materials are revised and prepared in electronic format, including lecture notes, tutorials and laboratory instructions, PowerPoint and web-based presentations etc. The teaching and learning materials are uploaded into a departmental server to provide a common module delivery file (MDF), which can be accessed by staff and students in different campuses. The arrangement is found effective as quality and consistency could be ensured. Students have benefited too as they could refer to the teaching and learning materials at their own pace and time to suit their learning pattern and ability. Staff members are also able to update or supplement additional teaching materials to suit the learning pattern of the students accordingly.

The second phase of implementation is to employ an IT platform for course management and effective communications with the students via the network. The department is in the process of adopting the WebCT for this purpose. It is anticipated that with the use of this software, more interactive and programmed learning could be achieved including on-line exercises, quizzes, discussion forums, student feedback etc. Staff members will be able to monitor the progress of individual students more closely and at the same time keep track of the in-course assessments more efficiently. The third phase of development involves extensive use of multimedia to enhance the teaching and learning materials. This is particularly useful and important for the type of students taking these courses, who are in general less academically inclined. With the use of multimedia presentations, involving animation and simulation in the course-ware wherever possible, students will have a much better understanding and interest in the learning process.

The use of IT for continuous professional development (CPD) is another top priority of this department. With the help of outside Internet providers, CPD could be effectively delivered to a much wider audience particularly for engineering professionals, due to their work nature and geographic location, who might have difficulties following a rigid time scheduled learning programme. Offering Internet or web-based CPD programme is definitely an excellent alternative.

PARTNERSHIP WITH INDUSTRY

To enhance vocational education, an important consideration must be given to establish a close relationship with industry. The department has in the past appointed industrial advisers to sit on advisory committees on different levels of course management. Additional input is also obtained through surveys, course validation, industrial visits and student projects etc. The commitments between academic institutes and industrial companies are usually rather lukewarm if not superficial, possibly due to a lack of interest or resources. At the least, as pointed out in Sargeant et al (1997), such a perception of an academic/industry gap should be narrowed.

To be able to respond to the fast changing competitive international market and new technology, there is now a much greater need for academic institutes and the industry to have a closer cooperation. To begin with, the local industry should be actively involved in designing the course curriculum particularly to match and to meet the industrial requirements in terms of knowledge, skills and relevance. Secondly, the industry should help to provide support for staff and student training, preferably also involved in the running of the courses. In this respect, staff and students will be able to focus the teaching and learning more towards the industrial environment and hence improve the employment prospects of our students. It is therefore logical for academic institutes to form partnership with industrial corporations, seeking mutual support and to share resources, which can be beneficial to both parties.

An example to illustrate the benefit of such industrial partnership could be demonstrated with the department's CAD/CAE Centre. The Centre is now equipped with the most advanced software packages for Computer Aided Design and Computer Aided Engineering. It is supported by local

industry from software suppliers and from industrial companies with the need of such technology. It is therefore logical to establish a partnership with these local companies to promote activities that are mutually beneficial to the department and the local industry. Industrial corporations wishing to participate are encouraged to set up their design office either physically or virtually with the department. A joint design office or centre is ideally set up to meet both the needs of the industry and the training requirement of our students possibly with shared resources and expertise. This will then help the department and the industrial companies to save on expensive software and hardware and at the same time to ensure that the department is equipped with the most appropriate design tools as required by industry standards. Alternatively design tools and technical information could also be made available in a virtual space in a PC server, which could be accessed by both parties. Such arrangements would help staff and students to have the opportunity to engage in a realistic engineering environment and to get involved directly with industrial projects. However, staff and students involvement in industrial projects of this nature must be recognized as part of their curriculum and course work. Their contribution should be credited as part of the teaching and learning exercise.

Another area of cooperation could be in the form of engineering knowledge database and CPD programmes. In an information age, knowledge database is vitally important to engineering professionals not only to deal with routine work but also to update on the latest development of technology. With the advent of Internet, there is great incentive for academics as well as industrial corporations to jointly establish such a facility to share technical information and to promote professional activities using web sites. It is feasible and desirable to setup a database as part of an Internet portal to provide a wider access to the engineering community. The department is therefore currently working with an Internet incubator venture company to provide Internet portal for the disciplines in Maritime Technology, Building Services, Environment and Safety. The web sites are also intended for web based CPD programmes for life-long learning.

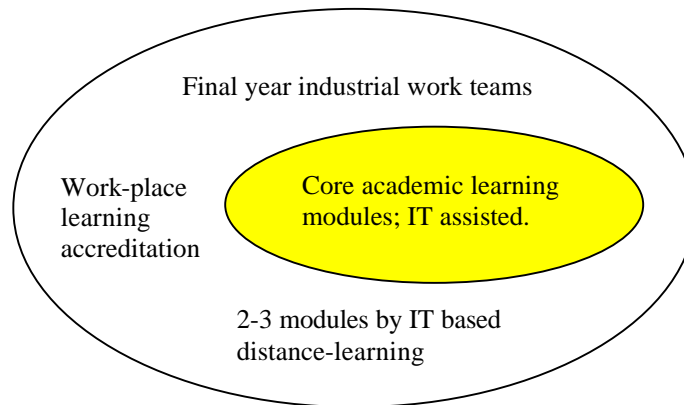
An Emerging Model

It is apparent from the preceding sections that to respond swiftly to market changes, the existing approach needs to operate differently and in particular, it should take advantage of IT. Industry or employers must be prepared to provide greater input, whilst a good balance of academic learning has to be kept. To develop the idea further, the boundary between academic institutions and the world of work would need to become more fluid and dynamic. It could be proposed further that an interface would be introduced in the final year of all courses, where project work with companies becomes the norm, whereby a lecturer/trainer would act as facilitator and lead students to solve problems for companies. It could also take the form of research and development for small firms, testing of equipment or system design. This would not only simulate the real work place, as it is the real work place. At the same time other qualities such as team work, communication and interpersonal skills development could be blended in too. The learning experience will not only be greatly enhanced, but also aligning to industrial needs.

In terms of IT application, it is to assist learning in core levels, then it is geared for distance-learning in the final year, where great flexibility to academic learning prepares for self-learning in the future. IT would also be used heavily for course administration in keeping track of progress of the diverse range of activities. A framework for this is depicted in Figure 1. To take advantage of this model further, a mechanism for accrediting work place learning should also be explored, for instance Wills(2000) offers some initial thoughts. As tomorrow's companies evolve, there would be a call for further innovation from vocational education providers. To nurture an innovative culture in a highly regulated sector, service providers could start experimenting with new ideas in continuing education,

which could take on many new forms that are discussed by Davis(1998). To be successful, another factor cannot be overlooked: a “national” accreditation/qualification scheme must be in place such that greater participation from potential learners would be assured of a nominal return at the least.

Figure 1: A conceptual framework for vocational education in engineering



QUALITY ISSUES

Quality of teaching and quality assurance in further or higher education are complex issues even in the existing classical educational environment characterised by a structured, static and classroom format. These issues become much more complex due to the need to closely follow the rapid changes in engineering technology and in particular the explosive development of the information technology as an important teaching/learning tool.

In general, teaching staff should satisfy the requirements for academic qualifications in given area of specialism and also the increasing demands for appropriate academic/practical knowledge in teaching. In addition, the teaching staff in vocational education should have a very good and up-dated practical experience and knowledge in their own engineering field.

Furthermore, in the information age, lecturers must quickly acquire a good knowledge of IT and skills for its application. Lecturers need these capabilities in order to prepare modern sophisticated learning packages, deliver their teaching materials by the new means, interact and communicate effectively with their students and peers through the new medium, assess and follow student performance on-line, administer and manage the courses and regularly participate in life-long learning for their own continuous professional development. Their IT competency will no doubt become another crucial factor, together with the infrastructure and other resources, in providing quality teaching in the near future.

Quality assurance is another important quality issue. The courses in operation now in the department (and the similar courses to be offered in near future) follow the established VTC quality assurance system. It includes internal validation and external accreditation. In addition, it involves quality management that provides consistency, uniformity and commonality, documented activities, monitoring and follow up. However, learning new skills and acquiring new knowledge as stages of the life-long learning process impose very big challenges not only to the design of appropriate programmes and training of capable teachers but to the design and implementation of appropriate quality assurance system as well. The need to act quickly to the changing needs of the economy/industry and the use of IT with its flexibility and variety *“is likely to require a considerable*

measure of flexibility, adaptability, responsiveness and even fluidity that may be difficult to reconcile with the regulatory and standardising pressures that accompany qualifications frameworks”.

The issue of the quality assurance framework is not an isolated concern that affects only this department. It is a “national” issue and the HKSAR will also have to address this topic including the reform of the education system and the definition of threshold achievement standards. In addition to such local quality assurance framework, input from international educational community will be bench-marked in order to provide reference for quality vocational programmes and training.

CONCLUDING REMARKS

This paper describes the efforts and aspiration of an engineering department that is proactively keeping pace with the fast changing operating environment. It seeks to move from a traditional product-oriented and supply-driven service provision to developing courses around customer requirements through partnership with employers, the key stakeholder to system output. Under this new approach, information technology is seen as an enabling tool that would greatly enhance the department’s capability and service provision. A successful transformation would form a strong basis for expanding into continuing education services as life-long learning gathers momentum.

To adapt closely to the changing environment, efforts by service providers and employers alone cannot bring about transformation or even significant changes. Major stakeholders, such as policy-maker and regulatory bodies should be equally innovative in their approach, creating flexible systems that current operating environment entails if vocational education is not to lag behind technological or economic developments. In short, the main task ahead is for the department to close the academic/industry gap, adding genuine value to its stakeholders.

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